

readers, since they have enabled him so speedily to bring out a new and improved edition.

The observations which we made in our previous notice will apply equally to the present edition, for the greater portion of the work is essentially the same, the additions consisting principally of some excellent directions for collecting and preserving Coleoptera and Lepidoptera by Mr. Wollaston and the Editor, and an address by the latter "to the young entomologists at Eton, Harrow, Winchester, Rugby, and at all other schools." In this Mr. Stainton is at great pains to point out to the young idea that the study of entomology is by no means the contemptible occupation that so many consider it, but that, on the contrary, it is not only pleasing and instructive in itself, but may also be of the greatest service in training the mind to habits of observation, and may even act as an incentive to the acquisition of much useful knowledge which would otherwise be regarded as desperate drudgery. We can agree most cordially with most of Mr. Stainton's propositions, although we fear, with himself, that he has preached "too long a sermon" to his younger readers, and we trust that his enthusiasm may meet its reward in raising up a new generation of entomologists. We are glad to see that a few pages have been devoted to notices of important new works on entomology, and hope that in future years this section of the work will receive more of the editor's attention.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

March 1, 1855.—Charles Wheatstone, Esq., V.P., in the Chair.

"On the Structure, Functions, and Homology of the Manducatory Organs in the Class Rotifera." By Philip Henry Gosse, A.L.S.

In this paper the author institutes an examination of the manducatory organs in the class Rotifera, in order to show that the various forms which they assume can all be reduced to a common type. He further proposes to inquire what are the real homologues of these organs in the other classes of animals, and what light we can gather, from their structure, on the question of the zoological rank of the Rotifera.

After an investigation of the bibliography of the class from Ehrenberg to the present time, in which the vagueness and inexactitude of our knowledge of these organs is shown, the author takes up, one by one, the various phases which they assume throughout the whole class; commencing with *Brachionus*, in which they appear in the highest state of development. Their form in this genus is therefore taken as the standard of comparison.

The hemispherical bulb, which is so conspicuous in *B. amphicerus*, lying across the breast, and containing organs which work vigorously against each other, has long been recognized as an organ of manducation: it has been called the gizzard; but the author proposes to

distinguish it by the term *mastax*. It is a trilobate muscular sac, with walls varying much in thickness, receiving at the anterior extremity the *buccal funnel*, and on the dorsal side giving exit to the *æso-phagus*.

Within this sac are placed two geniculate organs (the *mallei*), and a third on which they work (the *incus*). Each *malleus* consists of two parts (the *manubrium* and the *uncus*), united by a hinge-joint. The *manubrium* is a piece of irregular form, consisting of *carinæ* of solid matter, enclosing three areas, which are filled with a more membranous substance. The *uncus* consists of several slender pieces, more or less parallel, arranged like the teeth of a comb, or like the fingers of a hand.

The *incus* consists of two *rami*, which are articulated by a common base to the extremity of a thin rod (the *fulcrum*), in such a way that they can open and close by proper muscles. The fingers of each *uncus* rest upon the corresponding *ramus*, to which they are attached by an elastic ligament. The *mallei* are moved to and fro by distinct muscles, which the author describes in detail; and by the action of these they approach and recede alternately; the *rami* opening and shutting simultaneously, with a movement derived partly from the action of the *mallei*, and partly from their own proper muscles.

All these organs have great solidity and density; and, from the action of certain menstrua upon them, appear to be of calcareous origin.

The writer proceeds to describe the accessory organs. The ciliated disc has an infundibuliform centre, which commonly merges into a tube before it enters the *mastax*. The particles of food that float in the water, or swimming animalcules, are whirled by the ciliary vortex into this tube; and, being carried into the *mastax*, are lodged upon the *rami*, between the two *unci*. These conjointly work upon the food, which passes on towards the tips of the *rami*, and enter the *æso-phagus*, which opens immediately beneath them.

From this normal condition, the author traces the manducatory organs through various modifications, in the genera *Euchlanis*, *Notommata aurita*, *N. clavulata*, *Anuræa*, *N. petromyzon*, *N. lacinulata*, *Furcularia*, *N. gibba*, *Synchæta*, *Polyarthra*, *Diglena*, *Eosphora*, *Albertia*, *F. marina*, *Asplanchna*, *Mastigocerca*, *Monocerca*, and *Scaridium*. Some of these display peculiarities and aberrations highly curious. Notwithstanding the anomalies and variations which occur, however, the same type of structure is seen in all; and the modifications in general may be considered as successive degenerations of the *mallei*, and augmentations of the *incus*.

The form of the manducatory organs, which occurs in *Triarthra*, *Pompholyx*, *Pterodina*, *Æcistes*, *Limnias*, *Melicerta*, *Conochilus*, *Megalotrocha*, *Lacinularia*, and *Tubicolaria*, is next examined. The organs are shown to be essentially the same as in the former type, but somewhat disguised by the excessive dilatation of the *mallei*, and by the soldering of the *unci* and the *rami* together, into two masses, each of which approaches in figure to the quadrant of a sphere.

Attention is then directed to what has been called (but by a misapprehension) the "stirrup-shaped" armature of the genera *Rotifer*, *Philodina*, *Actinurus*, &c. Here, however, the organs are proved to have no essential diversity from the common type; their analogy with those last described being abundantly manifest, though they are still further disguised by the obsolescence of the *manubria*.

Floscularia and *Stephanoceros*, the most elegant, but the most aberrant forms of Rotifera, close the series. The *mastax*, in these genera, is wanting; and in the former genus the *incus* and the *manubria* are reduced to extreme evanescence, though the two-fingered *unci* show, in their structure, relative position and action, the true analogy of these organs.

Having thus shown that there is but one model of structure, however modified or disguised, in the manducatory organs of the Rotifera, the author proceeds to the question of their homology. He argues on several grounds that they have no true affinity with the gastric teeth of the Crustacea, though he states his conviction that the Rotifera belong to the great Arthropodous division of animals.

It is with the Insecta that the author seeks to ally these minute creatures; and, by a course of argument founded on the peculiarities of structure already detailed, he maintains the following identifications:—that the *mastax* is a true *mouth*; that the *mallei* are *mandibles*; the *manubria* possibly representing the *cheeks*, into which they are articulated; that the *rami* of the *incus* are *maxillæ*; and that the *fulcrum* represents the *cardines* soldered together.

While the author maintains the connexion of Rotifera with Insecta, through these organs in their highest development, he suggests their affinity with Polyzoa, by the same organs at the opposite extremity of the scale, since the oval muscular bulbs in *Bowerbankia*, which approach and recede in their action on food, seem to represent the quadriglobular masses of *Limnias* and *Rotifer*, further degenerated.

If this affinity be correctly indicated, the interesting fact is apparent, that the Polyzoa present the point where the two great parallel divisions, Mollusca and Articulata, unite in their course towards the true Polypi.

March 22.—The Lord Wrottesley, President, in the Chair.

"Further observations on the Anatomy of *Macgillivraya*, *Cheletropis*, and allied genera of pelagic Gasteropoda." By John Denis Macdonald, Esq., R.N., Assistant-Surgeon H.M.S.V. 'Torch.'

The author states, that in a late voyage from Sydney to Moreton Bay, specimens of *Macgillivraya*, *Cheletropis*, and a few other genera of minute pelagic Gasteropoda, apparently undescribed, were daily taken in the towing-net, and afforded him an opportunity of more precisely determining the mode of attachment of the ciliated arms which he had at first presumed to be naked branchiæ.

In his former paper* it was stated, more particularly of *Cheletropis*

* Annals, p. 232.

Huxleyi, that the gills were of two kinds, viz. "covered" and "naked;" the former, corresponding to those of the pectinibranchiate Gasteropoda generally, he has never found to be absent in any of the genera; but from further observation of the so-called naked gills, while the animals were alive in their native element, he is disposed to think that they are chiefly employed for prehension, and probably as auxiliary organs of natation. When these ciliated appendages are fully extended, the line of cilia is perfectly straight, so that the frilled border, noticed in the previous account, turns out to be a character depending simply on the partial contraction of the longitudinal muscular fibres, preparatory to complete retraction of the organs. They have no connexion with the mantle, but encircle the mouth together with the tentacula and eyes, and coalesce at their bases like the segments of a deeply-cleft calyx. In the specimens of *Macgillivraya* examined the arms were quite transparent, but marked at irregular intervals with cross streaks of brownish purple. In the extended state they were several times the length of the shell, and, like the arms of a polype, they rolled themselves up when touched, and started back into the shell with surprising rapidity. They appeared also to be exquisitely sensitive, exhibiting short twitching movements when minute particles suspended in the water came in contact with them.

In the specimens of *Macgillivraya* now referred to, the respiratory siphon consisted of a process of the mantle converted into a tube by the mere apposition of its borders without organic union; it was moreover much shorter than had been usually observed in previous examples, and the author thinks that those now under consideration may be a variety, if not a distinct species.

In his former examinations of this tribe of Gasteropoda, the author had never found more than four arms encircling the head, but he has since discovered six in a single genus with which he had been long familiar by external characters. In this case the operculigerous lobe of the foot is quite cylindrical and of some length, bearing the peculiar operculum on its truncated extremity with the clawed process pointing to the left side. The sucker-disc is very small, and presents an anterior and posterior lobe. The two tentacula bear each an ocellus on the outer side near the base, and the ciliated arms, in every respect save number, resemble those of *Macgillivraya* and its congeners. The clawed operculum is developed from a spiral nucleus situate near the internal thickened border; it seems to be a weapon of defence, and is wielded with great dexterity by the little animal, which makes skips and jerks by means of its complex foot, after the manner of *Nassa* or *Strombus*.

The author notices another member of this diminutive tribe which is very commonly met with in the South Pacific, and has almost an indefinite range. As regards both animal and shell, it in many points resembles a miniature *Natica*. The shell is few-whorled, with small compressed spire and ventricose mouth; the operculum paucispiral and well-marked with the lines of growth. The foot is not unlike a broad and square-toed shoe in form, receiving or bearing

the remainder of the animal and the shell. The shoe-upper, as it were, presents two rounded lateral lobes which lie over the anterior part of the shell, like the mentum of *Natica*. The little animal creeps on its foot with great rapidity, appearing rather to slide along than progress by a vermicular movement, and by spreading out and hollowing this organ at the surface of the water, as a freshwater Lymnaead forms a boat of its foot, it buoys up its tiny body and is cast abroad on the face of the ocean.

“On the Anatomy of *Nautilus umbilicatus*, compared with that of *Nautilus Pompilius*.” By John Denis Macdonald, Esq., R.N.

During a visit of H.M.S.V. ‘Torch’ to the Isle of Pines in July 1854, a recent specimen of *Nautilus umbilicatus* was picked up on the outer reef off Observatory Island. It was alive when brought on board, but was too much exhausted to exhibit active movements. Part of the hood appeared to have been eaten away behind by some predaceous enemy, but in other respects the animal was perfect.

The body when retracted lay more deeply in the shell than that of *N. Pompilius*, so that no part was visible in a lateral view, and on account of the great depth of the chamber of occupation the orifice of the siphuncle in the last septum could not be seen when the soft parts were removed. As to this difference, however, the author observes that it may depend on the time elapsed since the formation of the last partition.

Apart from the shells, the author finds a close resemblance between the corresponding parts of the two species.

The specimen of *N. umbilicatus* examined proved to be a female; a fact which may serve to modify the views of those who, adopting the speculations of D’Orbigny on the sexes of the Ammonites as indicated by the characters of their shells, apply them also to the several kinds of *Nautili* known.

The body of *N. umbilicatus* is larger and more elongated than that of *N. Pompilius* as it occurs in the South Seas, although the specimens of the latter species brought from the Chinese Seas much exceed both in size. In the *N. umbilicatus*, the longitudinal lamellæ on the median lobe of the external labial processes are divided by a wide groove into two lateral sets, and the corresponding lamellæ between the internal labial processes are about seventeen in number and of considerable thickness. In *N. Pompilius*, the latter lamellæ are much thinner and more numerous, and the lateral sets of the former are united together in the median line, commencing anteriorly with an azygos transverse lamina. In both kinds, however, the corresponding tentacula may be distinctly traced out, with only such minor differences as might be expected to occur in different specimens of either separately; the digital, labial and ocular groups agreeing sufficiently both as to number and character in the two cases, considering the liability of these parts to slight modifications, from arrest of development or redundance, in the same species.

Referring to former observations of his own on the eye of *N. Pompilius*, the author observes that they closely apply to *N. umbilicatus*,

which affords confirmation of his opinion that the pigmentary coating is subjacent to the retina. He finds no vestige of a lens, and in place of vitreous humour, a mere viscous matter protecting the retina from the sea-water.

The organ of hearing, which had escaped detection in the specimen of *N. Pompilius* dissected by Professor Owen, altered as it doubtless had been by long immersion in spirit, was discovered in the example of *N. umbilicatus* examined by the author. It consists of two spheroidal acoustic capsules placed, one on each side, at the union of the supra- and subœsophageal ganglia, and measuring about one-twelfth of an inch in diameter. Each capsule rests internally against the nervous mass, and is received on its outer side into a little depression in the cephalic cartilage. It is enveloped in a kind of fibrous tissue and filled with a cretaceous pulp consisting of minute, elliptical, otoconial particles, presenting under a high power a bright point near each end, varying much in size, and sometimes combined into stellate, cruciform or other figures. Cilia were not observed within the capsules.

The inside of the mouth is furnished with three groups of papillæ, one of which occupies the median line between the orifice of the tongue-sac and commencement of the œsophagus. These lingual papillæ, as well as the rest, are clothed with long and slender columnar epithelium-particles.

The author agrees with Mayer in regarding the well-known follicular appendages of the afferent branchial vessels of the Cephalopoda, as performing the function of kidneys, but admits that they may also serve, by altering their capacity, to regulate the amount of blood passing through the branchiæ under changes of pressure to which the animal may be subjected at different depths. These follicles are subcylindrical in form, and somewhat dilated at the free extremity, to which is appended a folded and funnel-shaped process of membrane which expands rather suddenly and presents a jagged border. They open by an oval or slit-like orifice into the afferent branchial vessels, on each of which, as Professor Owen has observed, they are disposed in three clusters. The outer membrane is smooth and glossy, homogeneous in structure, and sprinkled over with minute, rounded, transparent bodies, resembling the nuclei of cells. Beneath this layer, flat bundles of fibres, apparently muscular, are traceable here and there, principally disposed in a longitudinal direction, and sometimes branched. The lining membrane consists of a loose epithelial pavement, similar in many respects to that of the uriniferous tubules of the higher animals, the cells containing, besides the nuclei, numerous minute oil-globules, or a substance much resembling concrete fatty matter. This membrane is thrown up into very numerous papillæ and corrugations, so as greatly to increase the extent of surface. The papillæ are more numerous towards the attached end, and a circlet of longitudinal folds, with transverse zigzag corrugations, radiate from the bottom of the follicle, in which a number of small pits or fenestrations are sometimes visible. The funnel-shaped membranous process above noticed is

continuous with the lining membrane. The cavity of each follicle, therefore, communicates with the exterior through the centre of this process, and the aperture is thus guarded by a kind of circular valve permitting the escape of secreted matters, but effectually preventing the entrance of fluid from without.

Some considerations are next offered in support of the view adopted as to the functions of these vascular appendages.

Lastly, on the question whether the peculiarities of structure recognized respectively in *N. Pompilius* and *N. umbilicatus* are sufficient to establish a difference of species, or are attributable merely to variety, the author observes, that any tendency in a being to revert to an original type, when such has been determined, betrays variety; but this tendency is never manifested in the *Nautili* under consideration by the occasional occurrence of specimens presenting characters which place them intermediately between *N. Pompilius* and *N. umbilicatus*. Having visited the Fijii Islands since he formerly wrote on *N. Pompilius*, he finds that the umbilicated *Nautili* are not known to the natives, although *N. Pompilius* is very plentiful; but at Fatuna or Wallis's Island, where both are found, the people recognize the difference between them depending on the presence or absence of umbilical pits. On this the author remarks, that although particular localities, with all attending circumstances, may favour the production of varieties, yet the permanence of the distinctive characters of these *Nautili* without symptom of amalgamation, and the discovery of a female specimen of *N. umbilicatus*, are strong arguments in support of the view that they are distinct species, though very closely allied.

LINNEAN SOCIETY.

June 20, 1854.—Thomas Bell, Esq., President, in the Chair.

Read the commencement of a paper "On the Structure of the Seed and peculiar form of the Embryo in the *Clusiaceæ*." By John Miers, Esq., F.R.S., F.L.S. &c.

The author stated it to be his object to direct the attention of botanists to the structure of the seed, and particularly of the embryo in this family, the nature of which had been hitherto quite misunderstood. During his residence in Brazil he had made several observations on the *Clusiaceæ*, which he hoped would assist in defining the characters and limits of the genera, hitherto very imperfectly described. These more general remarks would be reserved for a future occasion, his object being now confined, as a matter of primary importance, to the consideration of the seminal structure observable in this family.

He began by tracing a history of the facts and conclusions recorded on the subject. The earliest is that of Jussieu in 1789, where, in his ordinal character of the *Guttiferæ*, he states that the embryo is erect, without albumen, and with hard corky cotyledons, a character probably drawn only from *Calophyllum*. Gærtner next figured the analysis of three species of *Garcinia*, and described the seed as